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Subject: **Response to Iris Environmental's Comments on the March 13, 2002 *Soil Investigation, Shallow Soil Remediation, and Screening-level Risk Assessment, BRC Former C-6 Facility, Parcel C, Los Angeles, CA***

Dear Brian:

This letter has been prepared by Haley & Aldrich, Inc., on behalf of the Boeing Realty Corporation (BRC), in response to the comments provided by Iris Environmental in a letter dated October 2, 2002 regarding their review of the March 13, 2002 document entitled *Soil Investigation, Shallow Soil Remediation, and Screening-level Risk Assessment, BRC Former C-6 Facility, Parcel C, Los Angeles, CA* (March 2002 Report).

BACKGROUND

The comments provided by Iris Environmental were prepared on behalf of RREEF, a potential purchaser of the portion of Parcel C located south of Knox Street. This area consists of approximately 37 acres of the approximately 51-acre Parcel C property (herein referred to as the Site). It is understood from a review of the July 23, 2002 development plan of Harbor Gateway Phase II, prepared by Hill Pinckert Architects, Inc., that RREEF would develop the southern portion of the Site for commercial/light industrial purposes. The development plan includes the construction of two relatively large warehouse buildings. Each of these buildings is a rectangular-shaped on-grade structure, which includes a first floor and smaller mezzanine area, and multiple truck bays. The buildings would be positioned parallel with each other, with the longest side in a north-south orientation. Sixty-two truck bays are proposed along the entire interior north-south side of each building. The proposed first floor and mezzanine areas of one of these buildings are approximately 406,000 and 16,000 square feet, respectively. The proposed first floor and mezzanine areas of the other building are approximately 424,000 and 16,000 square feet, respectively. The proposed buildings would comprise approximately 54 percent of the land surface; approximately 15 percent would include landscaped areas, and the remaining approximately 33 percent would be paved parking.

STATUS OF REGULATORY REVIEW

Currently, both the Regional Water Quality Control Board – Los Angeles Region (LARWQCB) and the California Office of Environmental Health Hazard Assessment (OEHHA) are reviewing the March 2002 Report. It is anticipated that the LARWQCB will provide a letter to BRC during the next week that includes a summary of both their and OEHHA comments to the March 2002 Report.

Preliminary meetings with the RWQCB and OEHHA indicate that they will concur with the findings of the SRA, that the Site can be developed for unrestricted commercial/light industrial uses (i.e., no additional site remediation is necessary to protect human health).

BRC RESPONSE TO IRIS ENVIRONMENTAL COMMENTS

Iris Environmental's comments are presented below, followed by our responses.

COMMENT/RESPONSE NO. 1

Comment No. 1 - Groundwater Protection Assessment

Comment 1.1 – "The risk assessment presented in the March 13, 2002 document appears to have used a default soil dilution attenuation factor (DAF). The methods used to model chemical migration from unsaturated soils down to underlying groundwater have a significant impact on site specific target levels (SSTLs) calculated to establish safe Site conditions; therefore, SSTLs are very sensitive to the values selected for chemical specific DAFs. Site-specific DAFs should be calculated given the DAFs importance in the overall modeling prediction and resulting SSTL."

Comment 1.2 – "The risk assessment assumed a single soil DAF for all volatile organic compounds (VOCs) that might be present at the Site regardless of the individual chemical properties. The risk assessment should include calculations for soil DAFs factors by individual chemical."

Comment 1.3 – "Lastly, the risk assessment should illustrate that there is a buffer of clean soil before groundwater is encountered; otherwise, the use of a soil DAF in the modeling effort appears inappropriate."

Response to Comment No. 1

Response 1.1 – The site-specific soil attenuation factors, presented in the March 2002 Report, are conservative and appropriate for use at the Site. Their use underestimates actual chemical attenuation through vadose zone soil and, therefore, provides a conservative estimate of the potential threat to underlying groundwater quality. In the March 2002 Report, the term DAF is used to refer to groundwater dilution, not soil attenuation. It appears that your comment is referring to the soil attenuation factor, and we are herein responding with that assumption. The site-specific soil attenuation factors were derived for the Site using the guidance presented in Chapter 5.0 of the May 1996 LARWQCB document entitled *Interim Site Assessment & Cleanup Guidebook.* Each total soil attenuation factor has three components. These components account for 1) chemical-specific or chemical class-specific properties, 2) onsite vadose zone soil characteristics, and 3) depth to groundwater beneath the Site. The conservative soil attenuation factors tend to overestimate the mass of chemicals at the Site that would reach the groundwater table. The vadose zone transport assumptions of the LARWQCB methodology assume that the chemicals remain in the vadose zone at their original concentrations indefinitely and does not account for natural transport mechanisms, which will disperse the chemicals within the thickness of the vadose zone over time. In addition, the LARWQCB methodology conservatively assumes equal concentrations in soil and pore water at the water table, and equilibrium partitioning is only used at distances greater than 150 feet above the water table.

Response 1.2 – The chemical-specific or chemical class-specific (i.e., VOCs) soil attenuation factors, presented in the March 2002 Report, are conservative, and were derived for the Site following the guidance presented in Chapter 5.0 of the above-referenced May 1996 LARWQCB document. Using chemical-specific soil attenuation factors for individual VOCs would result in the same conclusion, that it is unlikely that residual chemical concentrations in shallow soil pose a threat to groundwater quality. For VOCs, the LARWQCB recommends that for the chemical property component of the soil attenuation factor, an average of maximum chemical-specific soil attenuation factors be used. This average value is based on maximum chemical partitioning characteristics in soil for common VOCs, including various ketones, petroleum hydrocarbons, and chlorinated hydrocarbons. Site-related VOCs detected in shallow soil at the Site that have promulgated California drinking water standards include petroleum hydrocarbons [ethylbenzene, methyl tert-butyl ether (MTBE), toluene, xylenes], and chlorinated hydrocarbons [carbon tetrachloride, chloroform, 1,1-dichloroethane (1,1-DCA), 1,2-DCA, 1,1-dichloroethylene (1,1-DCE), cis-1,2-dichloroethylene (cis-1,2-DCE), tetracloroethylene (PCE), 1,2,4-trichlorobenzene, 1,1,1-trichloroethane (1,1,1-TCA), 1,1,2-TCA, and TCE]. The range of soil attenuation factors reported by the LARWQCB for the above-noted VOCs is 17 for 1,2-DCA to 729 for PCE. The LARWQCB-derived average value of 255 was used in the groundwater protection assessment for the Site. This value appears to be a reasonable and conservative "average" for the Site.

The exposure point concentrations used in the March 2002 Report for the upper 12 feet of soil were compared to the calculated soil screening levels (SSLs) to assess the whether the use chemical-specific soil attenuation values for each chemical would trigger an unacceptable threat to groundwater quality. A review of Table C-1 of the March 2002 Report indicates that the SSLs are between 9 and 3,448 times higher than the exposure point concentrations. Reducing the average of the maximum soil attenuation factors for VOCs from 255 to 28, which is 9 times less than 255, would result in only one chemical, 1,2-DCA, having an exposure point concentration that is higher than its SSL. This chemical was detected in less than 1 percent of the 1,239 soil samples tested. Due to the low frequency of detection for 1,2-DCA and the conservative nature of the evaluation methodology, it is unlikely residual concentrations of VOCs in shallow soil pose a threat to groundwater quality.

Response 1.3 – The groundwater protection assessment results are valid whether or not there is a buffer of "clean" soil above the groundwater table beneath the Site. The groundwater protection assessment presented in the March 2002 Report provides a conservative evaluation of the potential for impacts in shallow soil to pose a threat to underlying groundwater. We agree that downward migration of chemicals from shallow soil can influence the sorptive capacity of underlying deeper vadose zone soil. However, the method employed in the March 2002 Report is intrinsically conservative because it underestimates or does not even address several other important attenuative processes such as dispersion, volatilization, and biodegradation. Although the groundwater protection assessment was conducted only for the upper 12 feet of soil, it is not specifically indicated that deeper soil is not impacted. The upper 12 feet of soil was evaluated separately to be consistent with the remediation strategy for the Site that addresses potential remediaton of shallow soil (i.e., the upper 12 feet) separately from deeper soil and groundwater. Based on the results of the health risk and groundwater assessments, shallow soil impacts that posed a threat to groundwater have been remediated by excavation; whereas remediation of deeper soil will be conducted using soil vapor extraction (SVE) technology.

COMMENT/RESPONSE NO. 2

Comment No. 2 – Data Issues Associated with Indoor Air Flux Estimation

Comment 2.1 – "The risk assessment assumed that soil gas samples at 12 feet will capture all potential sources of chemical flux below a building. For this to be true, all other soil gas concentrations at different depths must be below the flux concentration line[1]. This assumption should be checked for two reasons. First, construction of a building over contaminated soil can alter soil properties as well as soil gas flow patterns. Second, soil gas sampling only provides a short-term estimate of the potential flux of a compound. The same methodology used to determine the maximum flux of compounds at specified sampling depths should be used to ensure that this assumption is correct. By comparing the flux estimated from soil and groundwater concentrations to the flux generated by soil gas concentrations (especially in the cases where the soil gas concentrations are below the detection limit and predict no flux) the validity of your approach can be checked. As this could be a time consuming exercise, we recommend you focus on benzene to start, and extend to one or two other compounds most likely to be risk drivers."

[1] The flux concentration line represents the relationship between concentration and depth resulting from the assumption of steady-state flux. In our case, this line stretches from below the building, where the concentration is approximately zero, through the measured soil gas concentration at 12 feet, and on down to the groundwater table.

Comment 2.2 – "Given the high concentrations of VOCs in the subsurface, has there been any methane gas sampling? While not generally particularly dangerous on its own, on-going generation of high concentrations of methane gas can "push" other compounds up and into building faster than would be expected under diffusion only conditions."

Response to Comment No. 2

Response 2.1 – Collection of soil gas samples at 12 feet below ground surface (bgs) and the use of the analytical results for these samples in the March 2002 Report is appropriate and additional soil gas or flux chamber sampling is not needed after building construction. A review of the vertical distribution of VOC impacts at the Site indicate that the majority of impacts and the highest concentrations of VOCs are present at depths greater than the depths that the soil gas samples were obtained (approximately 12 feet below ground surface). Thus, soil gas samples were obtained at depths above the highest VOC concentrations. The vertical distributions of the VOCs contributing the majority of the impacts are visually depicted on Figures 8 through 14 of the March 2002 Report.

Although soil properties may be somewhat altered during site redevelopment, the soil gas sample results obtained provide a conservative estimate of soil gas concentrations after site redevelopment. After soil gas samples were collected, the shallow soil was remediated and post-remediation grading resulted in significant mixing and homogenization of soil within the upper 5 to 22 feet. Both of the post-remediation and grading activities resulted in a decrease in soil concentrations in onsite soil up to 22 feet bgs. Soil concentrations in deeper soil and groundwater will decrease overtime due to naturally occurring processes (such as biodegradation and volatilization) and as a result of deeper soil and groundwater remediation. Thus, the measured soil gas concentrations are conservative and provide an overestimate of current and future soil gas concentrations.

A comparison of the flux estimated from soil and groundwater concentrations to flux generated by soil gas concentrations for every VOC is not considered necessary. Calculating soil gas concentrations from soil and groundwater concentrations typically results in an overestimation of actual soil gas concentrations. Thus, these calculations were conducted only for those VOCs that were not tested for in soil gas. It is our opinion that due to the extensive soil gas sampling program across the Site, the soil gas measurements obtained provide a more accurate assessment of vapor concentrations within the upper 12 feet of soil than calculated values from soil or groundwater.

Response 2.2 – The potential for methane at the Site is not a factor in the migration of subsurface vapors beneath the Site. Methane sampling was not performed as part of the soil gas sampling program, but has been conducted in conjunction with SVE operations at the Site. Methane was not considered to be a site-related chemical; since, the primary VOC impacts at the Site are chlorinated hydrocarbons and the majority of the elevated petroleum hydrocarbon impacts have been excavated. Natural degradation of chlorinated hydrocarbon does not produce methane. In addition, there is no history of oil exploration or municipal landfills at the Site. Thus, it is not expected that elevated methane concentrations exist in the subsurface of the Site. This is confirmed by limited soil gas sampling for methane at the Site. Soil gas samples were collected from several onsite vapor extraction wells (2_VEW_9, 2_VEW_10B, 2_VEW_11B, 2_VEW_15BO) and the associated SVE system vapor inlet (GAC0002U) at the Site on October 16, 2002. The reported methane concentration range from an estimated concentration of 0.00011 to 0.00024 percent by volume. These concentrations are relatively low and confirm that methane is not considered to be a chemical of potential concern (COPC) at the Site, or an apparent contributor to measured VOC concentrations in soil gas.

COMMENT/RESPONSE NO. 3

Comment No. 3 – Model Use Associated with Indoor Air Flux Estimation

"The risk assessment assumed that advection is not a significant transport mechanism for the flow of VOCs into the proposed building. As advection is the most significant transport process, we request that you show that either the sources of pressure drop in the assumed building are negligible or the use of the Johnson and Ettinger (J&E) with advection turned on will result in flux estimates similar to those calculated. For example, in the case of a large warehouse building with small offices, one could use the J&E model with advection on to show that the size of the warehouse building results in low contaminate concentrations for the warehouse air, while a local HVAC system keeps the small offices ventilated and under positive pressure."

Response to Comment No. 3

Advection is not a significant transport mechanism for the migration of vapors into proposed onsite buildings. The use of the J&E model with advection "turned on" is not the most appropriate model for the Site due to the proposed onsite building construction. The proposed onsite buildings are not expected to have internal negative pressures, but instead are expected to be at equilibrium with atmospheric pressure (i.e., no pressure differential between the building interior and exterior). Thus, advective transport of subsurface vapors would be negligible. However, when negative pressure is assumed in the J&E model ("with advection turned on"), the indoor air inhalation risk levels are still higher using the County of San Diego Department of Environmental Health (DEH) vapor model than using the J&E model with site-specific parameters.

As indicated previously, two relatively large warehouse buildings (each greater than 400,000 square feet) are proposed to be constructed at the Site. Each of these buildings will contain numerous truck bays. Based on the anticipated use of these buildings, it is expected that the truck bays will be open the majority of the day, thus allowing continued natural ventilation with the outside air.

The excess lifetime cancer risk associated with a TCE in soil gas concentration of 275,000 micrograms per cubic meter (ug/m^3) as presented in the March 2002 Report using the DEH is 2 x 10^{-6}. An excess lifetime cancer risk of 7 x 10^{-8} was estimated for an occupational worker assuming the same soil gas concentration using the J&E model and the following assumptions:

- site-specific soil parameters same as used in the DEH model,
- soil gas measurement depth same as used in the DEH model,
- indoor air exchange rate for a commercial building of 0.83 exchanges per hour,
- occupational worker exposure duration same as used in the DEH model,
- an enclosed space height of 16 feet, consistent with the proposed building design,
- a building footprint square footage of 400,000 square feet (smaller of the two proposed buildings shown on the July 23, 2002 site development plan, and
- J&E default values used for other parameters including the soil-building pressure differential of 40 g/cm-s^2.

The above J&E modeling scenario is conservative in that it assumes a soil-building pressure differential similar to a commercial building; whereas, the two proposed onsite buildings would likely have negligible negative pressure differentials. Considering a negligible soil-building pressure differential, the J&E model provides an even lower estimated excess lifetime cancer risk of 6 x 10^{-10}, significantly lower than the risk presented in the March 2002 Report.

COMMENT/RESPONSE NO. 4

<u>Comment No. 4</u> – <u>Populations Selected for Quantitative Evaluation Within the Risk Characterization Process</u>

"The risk assessment only quantifies risks to future commercial workers, with the logic being that protection of future commercial workers will protect all other commercial/industrial populations. This may not be true for noncarcinogens, particularly those noncarcinogens where exposure via direct contact drives the risk (i.e., non-VOCs). Since a construction worker could, in fact, be exposed throughout the period of development, and a higher soil contact will occur during construction period, the noncancer risk-based concentrations may be lower than the noncancer numbers for a standard commercial worker exposed for 25 years. Thus, the analysis may not be protective of a construction worker. We recommend that risks to a construction worker be specifically quantified, and default exposure assumptions recommended by DTSC (e.g., 480 milligrams per day soil ingestion rate) be incorporated to account for the higher soil contact that occurs during construction activities. Further, the LeadSpread model should be re-run, specifically accounting for the construction worker, as the predicted blood-lead concentrations will be higher for the construction worker than for the commercial/industrial worker."

Response to Comment No. 4

The SRA, presented in the March 2002 Report is protective of construction workers, even if the suggested increased ingestion rates are used. The total hazard index for a construction worker is less than the target threshold of 1.0, even after adjusting exposure assumptions to specifically account for suggested potential increases in soil ingestion rate for a construction worker. The total hazard index for the direct contact pathways increases from 0.027 to 0.19 when the soil ingestion rate is increased from 50 to 480 mg/day. A further review of the other exposure assumptions used in the March 2002 Report indicate that they are protective of a construction worker. Thus, no modifications to other exposure parameters were evaluated. Since, the inhalation of indoor air pathways is not complete for the construction worker, the total hazard index for a construction worker would be 0.19, which is less than the target total hazard index of 1.0. Increasing the soil ingestion rate in the LeadSpread model results in an acceptable lead concentration in soil of 370 mg/kg, which is greater than the exposure point concentration for lead of 9.8 mg/kg. Thus, onsite concentrations of lead do not pose a potential for adverse health effects, even after increasing the soil ingestion rate from 50 to 480 mg/day.

COMMENT/RESPONSE NO. 5

Comment No. 5 – Averaging of Non-VOCs for Determining Representative Exposure Concentrations Within the Risk Characterization Processs

"For all non-VOCs, the risk assessment used a 12-foot average concentration as the potential exposure concentration. The rationale for averaging across the top 12 feet is not clearly presented, and the justification for such an approach would depend, in part, on the distribution of chemicals across the Site. As an example, if the distribution of the arsenic across the Site is such that the highest concentrations of arsenic exist within the top foot of soil, and is virtually non-detectable at greater depths, then averaging down to a depth of 12 feet could underestimate a worker's actual exposure (i.e., unless a worker is digging down through to 12 feet, his most likely exposure will be to the "surface" soils). In this situation, exposures to future on-Site industrial workers should be estimated by calculating the representative concentration present in the "surface" soils."

Response to Comment No. 5

Exposure point concentrations based on average values are representative of actual site conditions that may be encountered by an onsite industrial/commercial worker. The derivation of shallow soil exposure point concentrations is consistent with OEHHA-approved risk assessment work plan for the Site (*Risk Assessment Work Plan,* dated November 29, 2000, and *Risk Assessment Work Plan Addendum No. 1,* dated July 11, 2001) and with U.S. Environmental Protection Agency (EPA) guidelines. Post-remediation grading resulted in significant mixing and homogenization of soil within the upper 5 to 22 feet. The lower of the maximum concentration and the 95 percent upper confidence limit of the mean concentration (95% UCL) was used as the estimated average potential exposure concentration for each chemical in shallow soil for which potential direct contact is assumed. The 12-foot depth interval was selected as the maximum depth likely to be disturbed during redevelopment activities, and, thus, the maximum depth that future receptors may be exposed to soil. Since the post-remediation grading activities resulted in the redistribution of soil between depths of 5 to 22 feet across the Site, it was assumed that soil within these depths may have been brought up to the upper 12 feet. Thus, exposure point concentrations for the upper 12 feet were derived using sample data within the pre-grade upper 12 feet, and sample date from deeper depths within the areas that were overexcavated and redistributed during grading activities. Approximately 250,000 cubic yards of "clean" import soil were also placed on the Site. Maps showing the "as-built" final cut depth, current rough grade elevations, and differential depths between current grade and pre-demolition site elevation have been provided by BRC under separate cover.

COMMENT/RESPONSE NO. 6

Comment No. 6 – Noncancer Hazard Evaluation Within the Risk Characterization Process

"We recommend that all chemicals, including the carcinogenic compounds, be evaluated for their potential to cause noncancer health effects. As an example, the carcinogenic PAHs are often evaluated for their potential noncancer effects through the use of a surrogate compound, such as pyrene. In part because the total projected noncancer HI is very close to the noncancer threshold of one, we would want to be sure that evaluating the noncancer effects of these compounds wouldn't alter the overall conclusions presented in the risk assessment."

Response to Comment No. 6

The noncancer health risk (hazard index) is less than the target total hazard index of 1.0, even after accounting for noncancer effects for non-VOC carcinogens. In addition, the total hazard index presented in the March 2002 Report is a conservative estimate of the potential for noncancer effects. The total hazard index was derived by adding the hazard indices for all chemicals into one total hazard index. This is a conservative screening approach, in that appropriately dividing the hazard index by target organ would result in lower hazard indices.

Generally, noncancer effects were not consistently evaluated for non-VOC carcinogens in the March 2002 Report. The potential for adverse noncancer health effects was further assessed for the PAHs, degradation products of DDT, and polychlorinated biphenyls (PCBs as Aroclors) that do not have chemical-specific noncancer toxicity values. For PAHs, noncancer toxicity values for pyrene were used. For DDE and DDE, the noncancer toxicity values for DDT were used, and for Aroclors 1242, 1248, and 1260, the noncancer toxcity values for Aroclor 1254 were used. The total hazard index for PAHs increased from 0.00061 to 0.00082. The total hazard index for DDT and its degradation products increased from 0.000044 to 0.00020, and the total hazard index for PCBs increased from 0.0059 to 0.028.

The total hazard index for a construction worker increases from 0.19 (indicated in the response to comment no. 4) to 0.21, which is still less than the target total hazard index of 1.0. The total hazard index for the representative onsite industrial worker remains 0.90 (hazard index associated with inhalation of indoor air of 0.87 plus the hazard index associated with direct contact of 0.033), which is also less than the target total hazard index of 1.0. It should be noted that although these total hazard indices are less than 1.0, they are an overestimate of the hazard index for these receptors. As indicated in the March 2002 Report, hazard indices are typically only summed for chemicals that have similar noncancer toxicological endpoints, by target organ or critical effect. Thus, summing the hazard indices for all of the COPCs at the Site, irrespective of their individual toxicological endpoints, is conservative in that it assumes that exposure to each COPC produces the same adverse health effect.

CONCLUSIONS

We appreciate the opportunity to respond to Iris Environmental's comments to the March 2002 Report. After considering and addressing their comments, it is our opinion that the conclusions presented in the SRA and groundwater protection assessment, presented in the March 2002 Report, remain valid. The LARWQCB and OEHHA are currently reviewing the March 2002 Report. Preliminary meetings with the RWQCB and OEHHA indicate that they will concur with the findings of the SRA, that the Site can be developed for unrestricted commercial/light industrial uses (i.e., no additional site remediation is necessary to protect human health).

Should you have any questions concerning the contents of this letter, please contact the undersigned at (619) 280-9210.

Sincerely yours,
HALEY & ALDRICH, INC.

Anita Broughton, REA, CIH
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